Popkin Potential Transnational Energy, Water, and Crop Management Cooperation in the Levant

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Abstract

Where there are consistent scarcities and shortages of energy, water, and food, such as in the Levant of the Eastern Mediterranean of West Asia, planners, scientists, and engineers seek to improve the quality of life and health of everyday people through technology. Although multiple-objective decision making can be traced to ancient Assyria and Egypt, great strides were made by Emperor Napoleon Bonaparte. Operations Research (OR) or systems analysis (SA) came into its own during the World Wars of the 20th century. During the early 21st century OR was enhanced by Artificial Intelligence (AI) and Big Data Analytics (BDA). Embedding this modern software into Supervisor Control and Data Acquisition (SCADA) systems and Human Machine Interface (HMI) make infrastructure across several sectors more reliable, effective, efficient with lower operation and maintainable costs. It also frees managers from depending on the knowledge and wisdom of retiring seat-of-the-pants old timers, who are “red gold.” Numerous professionals from various disciplines are required to make these technologies viable. This article evaluates if these modern technologies could improve energy, water, and crop production and management in the transnational Levant. It includes strengths, weakness, opportunities, and threats assessment.

Key words: Operations Research, Artificial Intelligence, Big Data Analytics, Supervisor Control and Data Acquisition, Human Machine Interface, energy, water, crops, food, management, decision-making, Levant.

1. Introduction

The Levant is a large area in West Asia which has a long history of resource scarcity (Popkin, 2024)

Figure 1 shows the region (Ansell, 2024)

Is it possible that transnational Operations Research (OR), Artificial Intelligence (AI), and Big Data Analytics (BDA) can improve and reduce scarcity operations and management for energy, water, and crops?

1.1 Software Background

Box 1. Common Operations Research Tools (Ngonadi, 2024)

Linear Programing.

- Simplex Method
- Graphical Method
- Sensitivity Analysis
- Dead Method

Transportation Problem

Post-Optional Analysis

Assignment Problem

Game Theory

Zero-Sum Game

Minmax and Maxmin Strategies

Mixed Strategies

Linear Programing approach to game theory

Network Analysis (PRT/CPM)

Nonlinear Programing

Integer, Dynamic, and Goal Programing

Sensitivity Analysis

Artificial Intelligence (Ticon, 2024)

“Artificial Intelligence is the intelligence of machines or software as opposed to the W of human or other animals. It is a field of study in computer science that develops and studies intelligent machines. Such machines are called AIs.

AI technology is widely used throughout industry, government, and science. Some high-profile applications are advanced web search engines (e.g. Google Search), commercial systems (Wedby, YouTube, Amazon, and Netflix), understanding human speech (such as Google Assistant, Siri, and Alexa), self-driving cars (eg. Waymol), generative and creative tools (ChatGPT and AI art), and superhuman play and analysis in strategy games (such as chess and Go).”

Box 2. Managed Aquifer Recharge

Foreign visitors are often surprised to see dry reservoirs acclaimed as “successful” in agricultural drylands and deserts of the Levant. The purpose of these dry reservoirs is facilitating artificial groundwater recharge and storage for irrigation distribution by irrigation water wells. This procedure is often referred to as managed aquifer recharge (MAR). The Arizona Water Resources Research Center in Tucson first demonstrated its effectiveness and efficiency in the 1960s at the center’s research farm under the direction of the center’s founder and director, engineer Sol D. Resnick. (Resnick, 1970)

Figure 2. What Artificial Intelligence actually is (MLT, 2024)

WHAT AI ACTUALLY IS

Data

Data Science

Value

Data

Selection | Sourcing | Synthesis

Data Engineering

Cleaning | Normalizing | Scaling

Exploration | Feature Engineering

Modeling

Model Selection | Training

Evaluation | Tuning

Operationalizing

Registration | Deployment | Monitoring | Retraining

CONSTRAINTS

Legal | Ethical/ Transparency | Historical (Bias) | Security

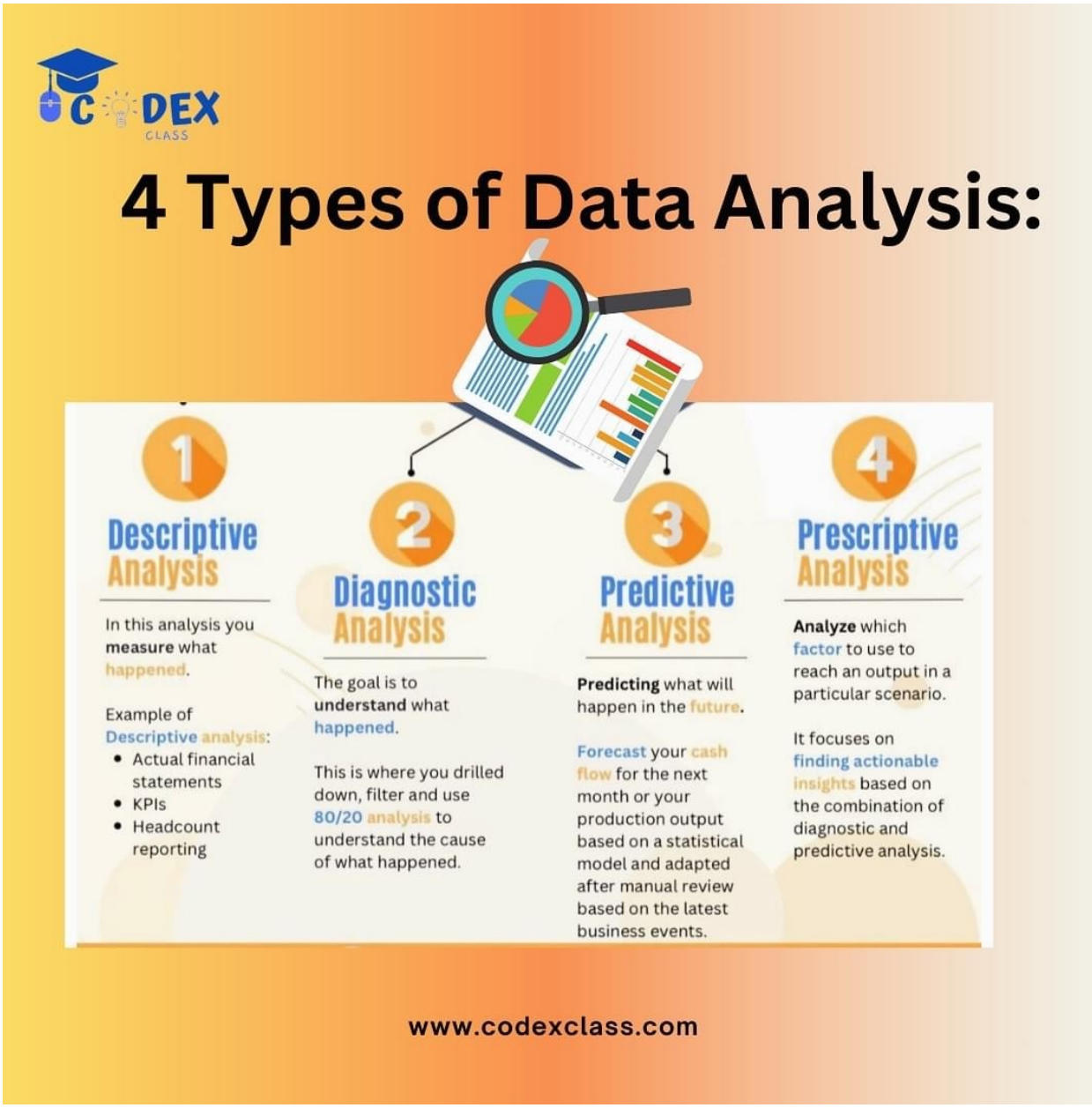
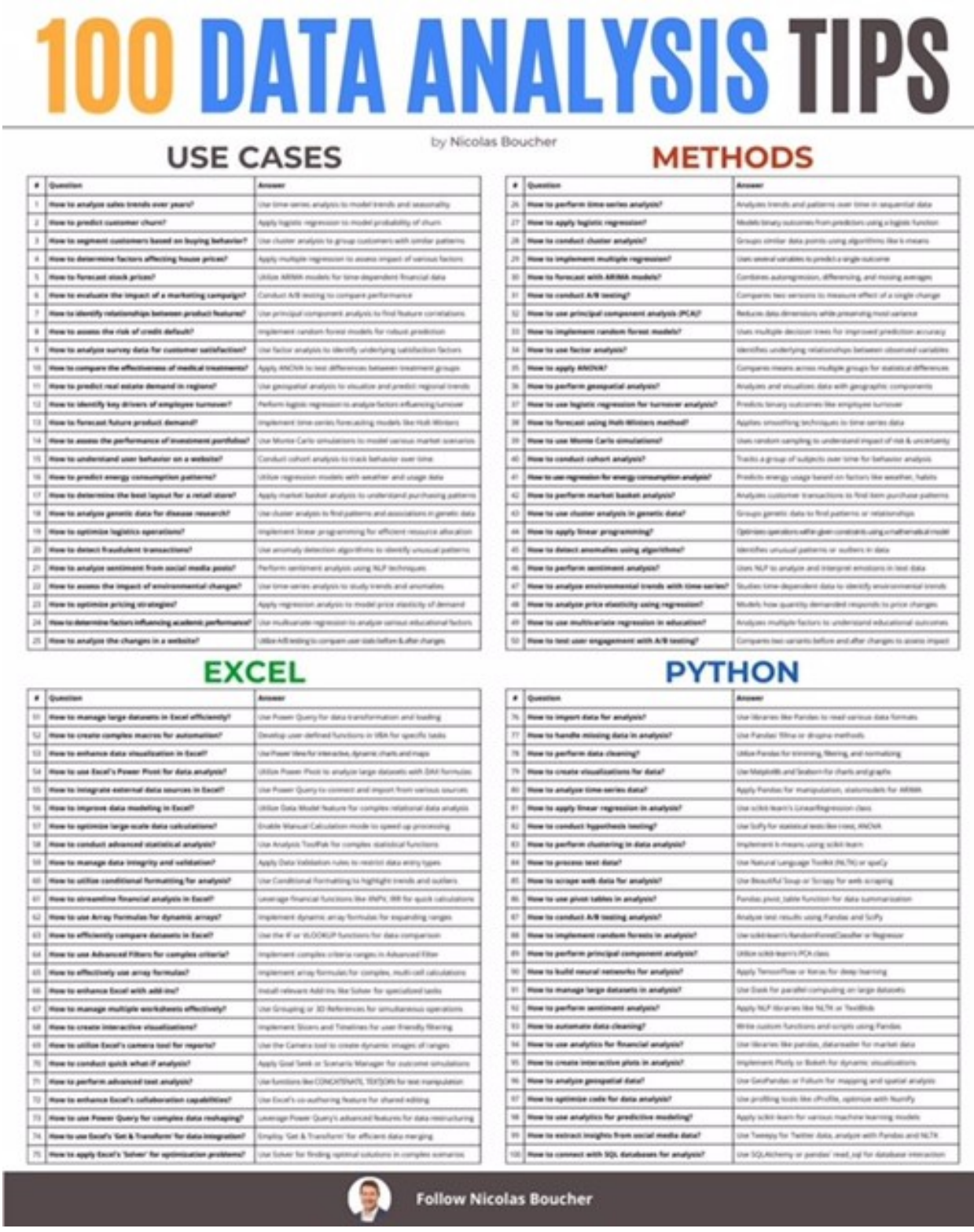


Figure 3, Four types of Data Analyses (Codexclass, 2024)

Figure 4, 100 Data Analytical Tips (MLTut, 2024)



1.2 Levant Background

The interaction of energy, water, and crop production is very strong in the Levant. Most electrical or petroleum-based energy is used to move water in order to produce food, feed, fiber, and energy to employ most people on developing countries. Employment is very important as the unemployed are more likely to demonstrate to overthrow their authoritarian governments.

Energy production in the Levant entails steam, water-head turbines, or fuel-based combustion engines to generate energy for one-time, non-storable use. Typical efficiencies of turbine and combustion systems are at best approximately 50-75%. There are potential renewable and sustainable energy resources such as solar, wind, tidal, hydropower, and sources such as landfill, animal waste, and wastewater plant methane and solid-waste-to-energy systems. Fuel pipelines, electrical transmission lines, electrical power stations and controls are necessary, as well as motivated and trained administrative, management, and technical operation and maintenance staff. Although nuclear energy is attractive to increase electrical energy availability, it’s often considered imprudent in the Levant, often in conflict if not open war.

Water provision for crop irrigation has its source in rivers, springs, and wells in the Levant. Levantine crops require large amounts of water due to high evapotranspiration and sandy soil permeability rates, and pre-irrigation to leach accumulated crop-intolerant salts from the active soil-water-crop profile. Consequently, in much of the Levant, the highest level of federal ministries with designated portfolios and budgets have titles like Ministry of Energy and Water, and Ministry of Agriculture and Irrigation with authority to monitor, allocate, and enforce federal policies. Since the end of the highly popular cooperative or socialist policy in Israel, Egypt, and Syria that federal or community centralization of water management was most efficient, decentralization of water allocation through water user associations and farm cooperatives is now common and more productive. However, higher water efficiency threatens to reduce employment, launching demonstrations to overthrow authoritarian governments.

Water provision for irrigation in the Levant entails pumping, canals, pipelines, lift stations, chemical and biological treatments, dry reservoirs for managed aquifer recharge, storage reservoirs or tanks, water filtration systems for drip or trickle irrigation, controls, and constant monitoring. For several decades, plastic tube and greenhouse farming has been implemented with high increase in productivity and decline in water consumptive use.

Finally, commercial production of human food, animal feed, and textiles in the Levant has always been a well-watched incompatibility of private and federal farmland ownership and management. Where there are private landowners, inheritance practices tends to subdivide farmland into smaller segmented patchwork with often abandoned

farm plots. Public or federal farmland ownership consistently is much less productive than private ownership. Farmers work best for themselves and not for the government.

Beyond squatting, land leasing, acquisition, or ownership, commercial farming requires plans, designs, surveys, soil testing, seed selection, soil preparation, and planting, engineering, water and pest control, monitoring (scouting), harvesting, sorting, cleaning, packaging and labeling, storage and transporting to points of sale, marketing, sales, contracting, and conformance to the trilogy of crop quality, environmental sustainability, and labor policies.

Box 3. Failed Transnational Cooperative Examples

At the end of the 20th century, visionary Carl N. Hodges of his Planetary Design Foundation, Phoenix, received approval from Israel's Yitzhak Rabin, Egypt's Hosni Mubarak, and Palestine's Hanan Ashraei. They authorized Carl to plan the 185-mile-long Seawater River Project from Gaza on the Mediterranean Sea to Eilat on the Gulf of Aqaba to the southeast. Carl's concept was to tap the Mediterranean Sea create an artificial river to produce ornamental edible seawater-loving plants for carbon capture, decoration, cosmetics, perfumes, landscaping, erosion control, human food and animal feed, and commercial shrimp, tilapia, milkfish, and honey production. The driving force was to use the natural nutrients from the sea to sustainably employ a great many Palestinians. Carl hosted me at his Phoenix complex to join his design team. Our team made a lot of progress but was disbanded when Rabin was assassinated by a Jewish extremist. (Hodges, 1995)

Other examples include sabotage of the Iraq-Turkey crude oil pipeline, hesitancy to support the Turkey-Israel water pipeline, Red to Dead Sea pipeline, and other transnational infrastructure projects in the Levant.

Moreover, during a project assignment in Amman in 2020, I met with the multitalented z Jordanian Minister of Water and Irrigation. a German-educated hydrology Ph.D., noted his frustration in water negotiations with a "brother." I commented that I knew Israel's could be difficult. His Excellency said something like, "No the Israelis are my cousins and we share water to both our advantage. It's my brothers, the Lebanese, who are difficult." I commented that I see him and then on television smiling, hugging, and kissing. His Excellency replied, "We kiss with daggers in our hands." (Jordanian Minister of Water and Irrigation, 2020)

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2. Materials and Methods

Over the past 30 years, several methods were applied to this article. They include data compilation and collection, key stakeholder interviews and surveys, focus groups exchanges, train-the-trainer

programs, and observation-conclusion-recommendation for project monitoring and evaluation. These are described in depth through USAID reports, retrievable through agency's online Development Experience Clearinghouse (DEC) at dec.USAID.gov.

In addition, the author made extensive use of YouTube, Facebook Groups, CIA world facts, Britannica, Wikipedia, Google searches, Wall Street Journal, New York Times, Financial Times, Guardian, USAID DEC, NYU economics, and regional and local English-language newspapers.

3. Results

Modern decision-making and management software reduces operating and maintenance costs and improves effectiveness and efficiency across an integrated network when linked to SCADA and HMI. This requires a well-trained and motivated team of multidisciplinary experts.

Figure 5, SCADA (Expro, 2024)

4. Discussion

The successful regional transnational application of OR, AI, and BDA requires a trained and motivated cadre of multi-disciplinary engineers. This condition is not currently or likely to meet the requirements in the Levant.

Moreover, cooperative efforts within the Levantine have generally failed. In 2014, I was team leader to evaluate the Lebanese water and wastewater sector for USAID and propose future USAID projects. My local team had a small office on the upper floor of an apartment house. There rarely was electricity for the elevator. I lugged myself to their office daily. I learned there was a Lebanese woman in charge of foreign donations to Lebanese infrastructure. I had a very difficult time arranging to interview her but was granted an opportunity. I met with her in her basement office. I asked about the delays in linking their sewage plants with to-be-built sewers, the mountains of solid wastes sluffing into the Mediterranean, and the instability of electricity. She blamed the donors and assured me electricity was stabilized. Then all the lights went out. I turned on my pocket black-aluminum flashlight which converted to candle. We conducted a cozy interview without mentioning electricity. I gave her my flashlights when I left her office. (Lebanese Foreign Dispersement Chief, 2014)

5. Conclusions

It’s been the dream of many academics, engineers, social scientists, and politicians that regional cooperation in Levantine energy, water, and crop production could be sustainable, commercially successful, and peace-forming as promoted by Friends of the Earth Middle East (now EcoPeace Middle East) (Brooks, 2014, Comier, 2023), and USAID Asia and Near East are main proponents of regional energy, water, and crop production.

Table 1 is a summary of the strengths, weaknesses, opportunities, and threats (SWOT) of applying modern infrastructure tools to the Levant. Although modern decision-making has come a long way from Wagner’s classic book now in several editions, (Wagner, 1970), it’s not likely Levantine managers will apply these new tools (Ngonadi, 2024) where there’s ongoing conflict, warfare, and sabotage.

Table 1. Strengths, Weaknesses, Opportunities, and Threats facing the Levant

Strengths
Similar language, religion, culture, foods, weather, climate, tourism, earth and sea resources, soils, rocks, minerals, water stress and scarcities
Weaknesses
Populations in all Levant countries are highly nationalistic, easily emotional and prone to extremism.

Other than Israel and Turkey, very high unemployment, poor governance, low percentage of income-earning women, inability to self-finance its infrastructure, low technology.

Widespread corruption, embezzling, nepotism, cronyism, favoritism, revolving doors,/ clientalism, political employments, bribery, controlled press, authoritarianism, assassinations, lack of transparency and free public debate, Lebanese confessionalism.

The normal condition is conflict and warfare.

Opportunities

As they all have energy, water, and food scarcity there's guarded optimism among a minority that the countries can overcome their grievances to cooperate towards meaningful solutions.

Threats

Social and political conflict, history of lost opportunities, radicalism, terrorism, conflict, and warfare.

If so, operations research, artificial intelligence, and big data analytics are likely to lead achieving this in the future. However, current and likely future conditions in the Levant preclude the potential success of regional transnational application of these modern softwares to its infrastructure decision-making.

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